© THE QUEEN'S PRINTER FOR ONTARIO
2000

REPRODUCED WITH PERMISSION

L'IMPRIMEUR DE LA REINE POUR L'ONTARIO

REPRODUIT AVEC PERMISSION

micromedia
a division of IHS Canada

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca

FACTSHEET
ISSN 1198-712X ©Queen's Printer for Ontario
Agdex#: 258-835 Publication Date: 05/00
Order#: 00-045 Last Reviewed: 05/00

Title: Management of Carrot Leaf Diseases

Division: Agriculture and Rural
History: Replaces Factsheet *Weather Timed Sprays for Carrot Blight Control* (Order No. 79-035)
Written by: J. Chaput

Table of Contents

1. Introduction
2. Biology and Symptoms
3. Monitoring and Disease Forecasting
4. Weather-Timed Fungicide Sprays
5. Other Management Stategies
6. Acknowledgements
7. For more information...

Introduction

Two fungal leaf diseases commonly affect carrots in temperate North America: *Alternaria* leaf blight and *Cercospora* leaf spot often weaken the leaves and petioles of carrots making mechanical harvesting less efficient. Bacterial leaf blight may also appear during wet growing seasons or later in the season when rows are closed and is caused by *Xanthomonas campestris* pv carotae. Harvesting losses tend to be greater if blighted leaves are also affected by heavy frosts. These blights rarely reduce growth of taproots in carrots unless infection occurs early and is left uncontrolled.

Management of carrot leaf diseases depends upon regular and consistent scouting, weather monitoring, disease forecasting, cultural controls and timed fungicide applications at threshold levels. Baby carrots and carrots grown for 'cut and peel' processing may be more susceptible to damage by leaf blights due to planting density and cultivar susceptibility.

| Top of Page |

Biology and Symptoms

Alternaria leaf blight is caused by the fungus *Alternaria dauci* and is initially characterized by irregularly shaped, brown spots surrounded by a yellow halo along the margins of leaves. (Figure 1)

Alternaria rarely infects the petioles of carrots. If the conditions are good for disease development, the lesions will join together causing the leaflets to shrivel and die appearing as though they are burnt.

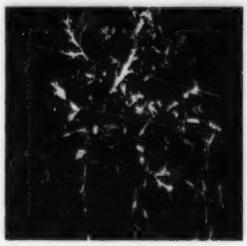

Figure 1. *Alternaria* leaf blight on carrot leaf

Alternaria blight can be easily confused with herbicide injury to carrot leaves also. *Alternaria* survives on seed and may overwinter on diseased crop residues left in the field as well as on wild carrot plants.

The fungal spore can be spread by wind, insects, water splashes, farm machinery and field workers. Cool, humid weather generally favours *Alternaria* blight. (Figure 2)

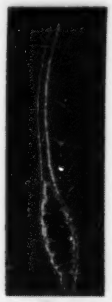

Figure 2. A spore of the fungus that causes *Alternaria* leaf blight. The spore is about 1/3 of 1 mm long and easily dispersed by wind.

Cercospora leaf spot is caused by the fungus *Cercospora carotae* and is initially characterized by circular or oval, tan to brown spots with a necrotic center. (Figure 3)

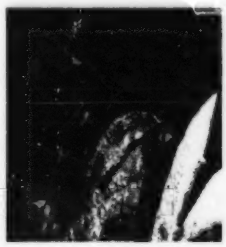

Figure 3. *Cercospora* leaf spot on carrot leaf.

Cercospora generally appears earlier in the season than *Alternaria*. The circular lesions may grow together until the entire leaflet shrivels and dies. *Cercospora* lesions can also be found on the petioles of leaves unlike *Alternaria* and this can significantly weaken the petioles making them detach from the crown prematurely. (Figure 4)

Neither *Cercospora* or *Alternaria* attack the carrot roots. *Cercospora* overwinters in the soil in crop residues and goes through several cycles of infection during the season depending upon weather conditions.

Figure 4. *Cercospora* leaf spot on carrot petiole.

Figure 5. Bacterial leaf blight on carrots - courtesy of Canadian Phytopathological Society (*External link - Please see disclaimer*).

Bacterial blight of carrots caused by *Xanthomonas campestris* pv *carotae* is much less common unless weather conditions are very wet and warm (25 - 30°C). Lesions on the leaves are characterized by irregularly shaped, dark brown spots with irregularly shaped yellow halos. (Figure 5)

If lesions appear on the petioles, they are generally dark and appear water-soaked. The symptoms of bacterial blight can be easily confused with *Cercospora* and *Alternaria*. The disease survives on seed and occasionally in the field in crop residues.

| Top of Page |

Monitoring and Disease Forecasting

As part of an integrated crop management program, the first key ingredient for leaf disease management is regular and consistent field monitoring. A minimum of 50-100 mid-age leaves should be sampled twice weekly starting in mid-late June and examined for the presence of carrot leaf diseases. In addition, monitoring weather conditions, and in some areas using disease forecasting models, will help to better time management strategies.

Researchers in Quebec developed a *Cercospora* leaf blight forecasting system that aids growers, consultants and processors with managing this disease. To cause infection, *Cercospora* requires 6 hours of dry weather (less than 90% humidity) for dissemination of the spores by the wind. It then needs a period of leaf wetness of at least 24 hours. The spores can survive interruptions in this wet period of up to 12 hours also. It has been calculated that lesions will appear 216 degree days later (base 0°C) depending upon the duration of leaf wetness and the average temperature during that wet period. For more information on this forecasting system, consult the Agriculture & Agri-Food Canada factsheet *Cercospora leaf blight of carrot, control strategies (External link, please see disclaimer)* published by HRDC, St. Jean sur Richelieu, Quebec, 1998.

The TOMCAST forecasting system used in tomatoes for the prediction of *Alternaria* has been shown to accurately predict the potential for *Alternaria* blight in carrots by researchers at the University of Guelph's Ridgetown College. For all blights of carrots regular field scouting, good record-keeping and correlation with weather, fertility, varieties and planting dates is essential.

| Top of Page |

Weather-Timed Fungicide Sprays

For many years a system which relies upon field scouting records and close attention to forecasted weather has been used to assist growers in managing the 2 fungal leaf diseases. Fungicides are not necessary until blight appears on 1-2% of the field leaf area. To determine the percentage of the leaf area infected sample 50-100 mid-age leaves across the whole field area. Be sure to make note of different varieties also. If blight is present on 1 in 4 (13 out of 50 leaves or 25 out of 100 leaves), this means that about 1-2% of the field leaf area is infected and the first fungicide spray should be applied. A leaf is counted as infected if one or more leaf blight lesions are found on the leaflets or petiole. The time of the season when blight reaches 1-2% varies considerably from year to year and between varieties.

If a blight forecasting system is not available in your area, it is possible to time subsequent fungicide applications based upon continued field scouting and forecasted weather. Apply fungicide only before the next forecasted rainfall or before the next night when the forecasted minimum temperature is 16°C or higher. Fungicides are not necessary before forecasted rains when forecasted temperatures are less than 9°C as commonly occurs in the autumn. The most serious infections of *Cercospora* blight occur when rainfall lasts several days and the temperatures

are warm (mid 20s C). Table 1 summarizes in general the effect of leaf wetness and temperature on *Alternaria* blight.

Table 1.Hours of leaf wetness required for infection of carrot leaves at various temperatures by *Alternaria* blight

Hours of leaf wetness required for infection

Mean temperature (°C)	Susceptible cultivars	Tolerant cultivars
7	72	---
8	49	72
9-10	25	35
11-12	16	22
13-15	11	15
16-20	9	12
21-25	8	10

The *Cercospora* leaf spot forecast may be more accurate, however not available to all carrot growing regions, therefore the weather-timed system can be used as an alternative. Interpreting weather forecasts can be difficult, however forecasts of 'scattered showers' indicate that the probability of rainfall is low and conditions for disease may also be low. On the other hand, forecasts of 'thunderstorms, frequent showers or periods of rain' indicate a higher probability of precipitation and that conditions for disease may be higher.

| Top of Page |

Other Management Strategies

Many other factors must be considered in the carrot leaf diseases management strategy. Planting disease-free seed and/or varieties with tolerance or resistance to leaf blight are important. Three or 4-yr crop rotations and deep plowing of crop residues may help reduce sources of disease inoculum. Improving air flow within the field by widening row spacings, reducing planting densities or selecting cultivars with upright growth habits may be helpful. Consider the positioning of early fields in relation to late fields so that prevailing winds do not carry spores from the early fields to the late fields. Keep the carrot plants healthy with a balanced fertility and irrigation program that promotes the plants' ability to defend against disease.

If fungicides are required, it has been shown that during most growing seasons, only a few judiciously timed sprays are necessary. Base fungicide applications on regular and consistent monitoring using established thresholds. Early carrots rarely need to be treated if they are harvested within 100 days and not close to late fields. The application of fungicides can be delayed or eliminated if crop scouting and weather conditions indicate that blight infection is unlikely. When conditions are dry and there is no rainfall, the time between fungicide applications can be extended to up to 14-20 days. Consult a crop specialist for more information and seed company representatives for information on leaf blight and leaf spot tolerant varieties.

| Top of Page |

Acknowledgements

The original manuscript for *Weather-Timed Sprays for Carrot Blight Control* was written by J. Sutton & T. Gillespie, University of Guelph, 1979. Updated May, 2000 by Jim Chaput, OMAFRA, Vegetable IPM Specialist, Guelph.

Gratitude is expressed to Dr. Odile Carisse, AAFC, St. Jean sur Richelieu, Quebec and M. Celetti, OMAFRA for reviewing the manuscript.

| Top of Page |

This Factsheet was written by: Jim Chaput, OMAFRA Vegetable IPM Specialist, Guelph
For more information...contact Jim Chaput

| Top of Page |

| Crops Home Page |

| Central Site | Feedback | Search | Site Map | Français |
| Home | What's New | Calendar | Products | News Releases |

Ontario
This page maintained by the Government of Ontario

This information is provided as a public service, but we cannot guarantee that the information is current or accurate.
Readers should verify the information before acting on it.

Feedback and technical inquiries to: crops@omafra.gov.on.ca
©Copyright 2000 Queen's Printer for Ontario
Last Updated: May 29, 2000